

東京帝國大學理學部紀要

第二類 地質學 礦物學 地理學 地震學

第四冊 第三篇

JOURNAL
OF THE
FACULTY OF SCIENCE
IMPERIAL UNIVERSITY OF TOKYO

SECTION II
GEOLOGY, MINERALOGY, GEOGRAPHY, SEISMOLOGY

Vol. IV Part 3

TOKYO

Published by the University

July 30, 1936

The "JOURNAL OF THE FACULTY OF SCIENCE" is the continuation of the "JOURNAL OF THE COLLEGE OF SCIENCE" published by the University in forty-five volumes (1887-1925), and is issued in five sections:

Section I.—Mathematics, Astronomy, Physics, Chemistry

Section II.—Geology, Mineralogy, Geography, Seismology

Section III.—Botany

Section IV.—Zoology

Section V.—Anthropology

Committee on Publication

Prof. K. Shibata, Dean, *ex officio*

Prof. S. Nakagawa

Prof. T. Kato

Prof. T. Nakai

Prof. N. Yatsu

All communications relating to this JOURNAL should be addressed to the
DEAN OF THE FACULTY OF SCIENCE, IMPERIAL UNIVERSITY OF TOKYO.

Older Cambrian Brachiopoda, Gastropoda, etc. from North-western Korea.

(With Three Plates)

By

Kazuo SAITO.

Contents.

	Page.
Introduction	346
Larger Faunal Horizons	346
Systematic Description	
Algae: <i>Girvanella manchurica</i> YABE et OZAKI	348
Spongiae: <i>Chancelloria exilis</i> sp. nov.	348
Cystoidea: Gen. et sp. indef. (cf. <i>Gogia</i>)	349
Brachiopoda: <i>Obolopsis margaritae</i> gen. et sp. nov.	349
<i>Obolus</i> cf. <i>detritus</i> MANSUY	351
<i>Obolus</i> sp. indef.	352
<i>Lingulella</i> sp. indef.	353
<i>Obolella lunaris</i> sp. nov.	353
<i>Botsfordia granulata</i> (REDLICH)	354
<i>Micromitra</i> (<i>Iphidella</i>) sp. indef.	355
<i>Acrotreta coreanica</i> sp. nov.	356
<i>Acrotreta</i> sp. indef.	357
Gen. et sp. indef. (Billingsellidae)	357
<i>Eoorthis?</i> sp. indef.	358
Gastropoda: <i>Helcionella acuticosta pacifica</i> subsp. nov.	358
<i>Scenella clotho</i> WALCOTT	359
<i>Coreospira rugosa</i> gen. et sp. nov.	360
<i>Hyolithus kotô</i> sp. nov.	361
<i>Hyolithus globiger</i> sp. nov.	361
<i>Hyolithus teretapex</i> sp. nov.	362
Appendix:—Changes in the Systematic Reference of Some Trilobites	
Previously Described by the Writer	363
List of Localities	363
List of Geographic Names	365
Literature Cited	365

Introduction.

In my previous papers I described 21 species of trilobites and conchostracans from the Late Lower and Early Middle Cambrian beds (equivalent of the Manto shale horizon) in the Chunghwa, Hwangju, and Sadong (Zidô) districts, south of P'yöng-yang, north-western Korea. In this paper I have described 20 species of non-crustacean fossils from the same beds. While most of the material was collected by myself, those from the Sadong district and a series of fine specimens of *Obolella* from the Chunghwa district were respectively collected by Mr. K. SAKAKURA and Dr. T. KOBAYASHI, both of our Institute, and placed at my disposal. To both these gentlemen I record here my best thanks. To the latter gentleman I am indebted for kind advice given me in the course of this study. I am grateful to Dr. S. TOKUNAGA and Dr. T. KATO who kindly looked over my manuscript.

Larger Faunal Horizons.

In the following list only the larger faunal horizons are considered. For more detailed stratigraphy the reader is referred to SAITO 1934, and SAKAKURA 1936. Very common species are indicated with two asterisks, those less common with only one, and the rare ones with none.

Ptychoparia beds (Early Middle Cambrian)

Gen. et sp. indef. (cf. *Gogia*)

Obolus sp. indef.

Lingulella sp. indef.

**Botsfordia granulata* (REDLICH)

Micromitra (*Iphidella*) sp. indef.

Acrotreta sp. indef.

Eoorthis? sp. indef.

Helcionella acuticosta pacifica subsp. nov.

**Hyolithus kotô* sp. nov.

**Hyolithus globiger* sp. nov.

Peronopsis rakuroensis (KOBAYASHI) [= *Agnostus chinensis* DAMES]¹⁾

***Eodiscus fusifrons* SAITO

1) The names in square brackets are those that were used in my previous papers. See appendix.

***Eodiscus spiniger* SAITO

**Oryctocephalus orientalis* SAITO

Oryctocephalus cf. *reynoldsi* REED

Oryctocephalus kobayashii SAITO

***Pianaspis kodairai* SAITO et SAKAKURA

***Proliostracus* ? *brevicaudatus* SAITO et SAKAKURA

Upper *Redlichia* shales (Late Lower Cambrian)

Bonnia zone (=Uppermost part,—M. Camb. ?)

**Botsfordia granulata* (REDLICH)

Helcionella acuticosta pacifica subsp. nov.

Scenella clotho WALCOTT

**Coreospira rugosa* gen. et sp. nov.

Bonnia tokunagai SAITO

**Bonnia* cf. *tokunagai* SAITO

The Upper *Redlichia* shales proper

Gen. et sp. indef. (cf. *Gogia*)

***Obolus* cf. *detritus* MANSUY

***Botsfordia granulata* (REDLICH)

Gen. et sp. indef. (*Billingsellidae*)

**Redlichia chinensis* WALCOTT

**Redlichia coreanica* SAITO

**Redlichia* cf. *walcotti* MANSUY

Neoredlichia nakamurai (SAITO), gen. nov. [= *Redlichia nakamurai*]

Lower *Redlichia* shales (Late Lower Cambrian)

Girvanella manchurica YABE et OZAKI

**Chancelloria exilis* sp. nov.

Obolus cf. *detritus* MANSUY

***Obolella lunaris* sp. nov.

Botsfordia granulata (REDLICH)

***Acrotreta coreanica* sp. nov.

***Redlichia chinensis* WALCOTT

Redlichia nobilis WALCOTT

Bonnia orientalis SAITO

**Cheiruroides primigenia* (SAITO) [= *Arthricocephalus* ? *primigenius*]

Bradoria subacuminata SAITO

Protolenus shale (Late Lower Cambrian)

**Obolopsis margaritae* gen. et sp. nov.

**Hyolithus teretapex* sp. nov.

**Protolenus coreanicus* SAITO

Aluta obsoleta SAITO

Systematic Description.

PHYLUM THALLOPHYTA

Classis Schizophyceae

Genus *Girvanella* NICHOLSON et ETHERIDGE

Girvanella manchurica YABE et OZAKI

Girvanella manchurica YABE et OZAKI, 1930, Sci. Rep. Tohoku Imp. Univ.,
2nd ser., vol. 14, p. 82, pl. 25, figs. 1-6.

This species is found in pisolites of about 1cm. diameter, from the pisolitic limestone at the base of the *Redlichia* shales north of Chunghwa. Our specimens are exactly like those of the original authors both in shape and in size.

Remarks.—The pisolites in the pisolitic limestone beds frequently met with in the Upper *Redlichia* shales of the Chunghwa district are crystallized. The existence of *Girvanella* in them has not yet been proved, although it is highly probable that the limestone once contained this primitive plant.

Horizon.—Late Lower Cambrian, Lower *Redlichia* shales.

Locality.—D10, north of Chunghwa, P'yöngan-namdo.

PHYLUM PORIFERA

Classis Spongiae

Ordo Hexactinellida

Familia Protospongiae

Genus *Chancelloria* WALCOTT

Chancelloria exilis SAITO, sp. nov.

(Pl. II, figs. 22, 23)

Quantities of casts of isolated sponge spicules occur in the argillaceous shales of the Lower *Redlichia* shales of the Chunghwa district. They have usually a small central body, the rays being often gently curved and usually slender, but sometimes strong. The greater number are represented by from one to three-rayed spicules, but sometimes even seven-rayed ones occur.

Remarks.—Many of our spicules are very similar to those of *C. eros* WALCOTT [1920, pl. 88] and of *C. yorkensis* WALCOTT [1920, pl. 87], while some resemble those of *C. libo* WALCOTT [1920, pl. 87], all from the Middle Cambrian of North America. As our spicules are widely separated from these American species in both geographical and geological distribution, it is given a new name.

Horizon.—Late Lower Cambrian, Lower *Redlichia* shales.

Localities.—T30, near Taktong; S11, north of Ssukkol; Hwangjukun, Hwanghai-do: etc.

PHYLUM ECHINODERMATA

Classis Cystoidea

Ordo Amphoridea

Familia Eocystidae

Gen. et sp. indef.

(Pl. II, figs. 20, 21)

Cf. *Gogia* WALCOTT, 1917, Smiths. Misc. Coll., vol. 67, p. 68.

External casts of polygonal plates comparable with the plates of calyx of primitive cystids, especially of *Gogia prolifica* WALCOTT from the North American Mount Whyte formation. Their surfaces, apparently somewhat rough, and without such grooves as seen in the American species.

Horizons.—Early Middle Cambrian, *Ptychoparia* beds (Ssukkol shale). Late Lower Cambrian, Upper *Redlichia* shales (*Neoredlichia nakamurai* zone).

Localities.—S4 (M. Cambr.), near Ssukkol, Heukkyo-myön, Hwanghai-do; I30 (L. Cambr.), near Chunghwa, P'yöngan-namdo.

PHYLUM MOLLUSCOIDEA

Classis Brachiopoda

Ordo Atremata

Superfam. Obolacea

Familia Obolidae

Genus *Obolopsis* SAITO, nov.

Primitive Obolid, closely related to *Obolus*, but distinguished from it by the lack of true palintropes in both valves.

Genotype.—*Obolopsis margaritae* SAITO, gen. et sp. nov.

Obolopsis margaritae SAITO, gen. et sp. nov.

(Pl. I, figs. 1–12)

Obolus? sp. SAITO, 1933, Jour. Geol. Soc. Tokyo, vol. 40, p. 245. (Describes stratigraphic occurrence.)

Rustella ?? sp. SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 212. (Do.)

Material.—A number of specimens in arenaceous shale; original shell substance preserved in many of them.

Description.—Valves subequal, the ventral slightly larger, sub-circular, gently convex, without true palintrope, margin of valves lying in one plane; surface marked by fine, concentric, rounded ridges, regularly arranged. Shell thin, thickened along inside posterolateral margin; shell substance chitino-phosphatic(?), pale greenish to pearly, structure foliated.

Ventral valve slightly acuminate; pair of shallow, minute depressions immediately in front of apex. Dorsal valve scarcely acuminate; with weak median sinus on surface and corresponding median ridge in the interior. Pedicle opening symbolothyric, short; usually indistinct pedicle grooves cutting the thickened posterior margins; ventral pedicle groove stronger and narrower than the dorsal, and in some specimens fairly strong.

In most specimens interior of valves shows scarcely any impressions of soft part of animal.

Only in the holotype of ventral valve (Pl. I, figs. 7, 8) are outlined what could be interpreted as the visceral area and the vascular system. The former narrow, extends forward from front of pedicle groove for about two-fifths of length of valve, and bounded on both sides by shallow grooves; its posterior part on same plane as general surface of interior, while its anterior part somewhat elevated, unlike in most Obolid species in which the visceral area appears to be a cavity. The vascular system represented by pair of low, broad, indistinct ridges which seem to unite in front. Between front margin of valve and the visceral area are many weak radiating rugosities.

The interior of dorsal valve seen in a number of specimens, in which a median ridge, broad and more or less strong, extends forward from front of the pedicle groove for about three-fourths to four-

fifths of length of valve, and is bounded on both sides by shallow grooves. On anterior part of median ridge, is a narrow median septum, comparable with those of *Obolus* [cf. WALCOTT, 1912, pl. 36, figs. 1e—h, pl. 63, figs. 10c, d, etc.]. From this it is clear that the visceral area is drawn far forward along the median line into the vascular area as in *Obolus*, etc. In small valve with strong median ridge (Pl. I, fig. 11), two pairs of vascular sinuses are shown, but identity of this specimen with present species is somewhat doubtful.

Remarks.—The thickened postero-lateral margins of the valves of our species appear like palintropes, which, however, are distinguished from the true palintropes of *Obolus*, *Lingulella*, etc. by the absence of growth-lines as seen in the outer surface of the valve.¹⁾ The absence of true palintrope indicates that the hemiperipheral growth of the shell was not followed by normal mixoperipheral growth. In this connection it should be mentioned that, according to THOMSON [1927], in the Obolidae and other Atremata, hemiperipheral growth is succeeded by mixoperipheral growth not only in their ontogenic, but also in their phylogenic development.

In its lack of a striated palintrope and the presence of a thickened postero-lateral margin, this species is comparable with *Elkania* FORD, *Obolus* (*Fordinia*) *bellulus* WALCOTT [1912, pl. 51], etc., which, however, have a well-developed 'internal cardinal area' [WALCOTT, 1912, p. 304] with a strong ventral pedicle groove. By assuming further deposition of shell matter in the posterior part of the ventral valve, our species would much be like these forms.

From these evidences this species could be regarded as a primitive Obolidae closely related to the supposed ancestor of this family.

In surface appearance this species is most allied to *Obolus* (*Palaeobolus*) MATTHEW, although the sculpture is weaker in the former.

Horizon.—Late Lower Cambrian, *Protolenus* shale.

Locality.—K15, Kuhyönch'i Pass, north of Heukkyo, Hwang-hai-do.

Genus *Obolus* EICHWALD

Obolus cf. *detritus* MANSUY

(Pl. I, figs. 14, 15)

Obolus? *detritus* MANSUY, 1912, Mém. Serv. géol. l'Indochine, vol. 1, fasc. 2, p. 20, pl. 1, figs. 2a-e.

1) Judging from the published figures, some species of '*Obolus*' seem to have no true palintrope, for example, *O. leda* WALCOTT [1924, pl. 106, fig. 14].

Lingulella sp. SAITO, 1933, Jour. Geol. Soc. Tokyo, vol. 40, pp. 247, 249.
(Gives stratigraphic occurrences.)

Lingulella spp. ind. (a), (b) & (c) SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11,
p. 213. (Do.)

Obolus cf. *detritus* MANSUY, SAKAKURA, 1936, Jour. Geol. Soc. Japan, vol. 43,
p. 107. (Do.)

Material.—A large number of specimens badly preserved in argillaceous shale. The following description is based on the four specimens from loc. Zd20.

Description.—Shell small (up to 5mm. in length), general outline elongate ovate, with ventral valve acuminate; valves gently convex. Surface of valves marked merely by concentric growth lines. Shell apparently thin. Most specimens do not show interior of valve. A specimen of dorsal valve (Pl. I, fig. 15) shows narrow, but distinct median ridge, on both sides of which are seen what may be traces of muscle scars.

Remarks.—Being poorly preserved, it is not certain whether all the specimens of *Obolus* from the *Redlichia* shales belong only to one species or to two or more species. If the former is the case, the species shows a great variation in the outline of the valves, some being almost rounded, while others have the elongate outline of the typical *Lingulella*. At any rate, most, if not all, of them seem comparable with MANSUY's species from Yunnan, one of a few species of *Obolus-Lingulella* group described from the *Redlichia* zone of Eastern Asia.

Horizon.—Late Lower Cambrian, Upper and Lower *Redlichia* shales; especially abundant in the *Obolus* zone of the Sadong district and in the *Redlichia* cf. *walcotti* zone of the Chunghwa district.

Localities.—Zd20, near Pultangni, SE of P'yöngyang, P'yöngnamdo; J11, near Antakkol, Heukkyo-myön, Hwanghai-do; and many other localities in the Sadong and Chunghwa districts.

Obolus sp. indef.

(Pl. I, figs. 16, 17)

A few poorly preserved Oboloid shells are found in the *Ptychoparia* beds of Sadong. Their valves have almost the same outline as the preceding species, although larger (up to 7mm. in length). A ventral valve (Pl. I, fig. 16) shows the palintrope.

Horizon.—Early Middle Cambrian, *Ptychoparia* beds.

Locality.—Zd87, Songsinni, SW of Sadong, P'yöngan-namdo.

Genus *Lingulella* Salter

Lingulella sp. indef.

(Pl. I, fig. 13)

A few valves of the *Lingulella* type, 4—9 mm. long, are found in the *Ptychoparia* beds of the Sadong district, one of which is illustrated. It seems not altogether improbable that this and the preceding species may prove on fuller knowledge to belong to one and the same species with a wide range of variation in shell-form.

Horizon.—Early Middle Cambrian, *Ptychoparia* beds.

Localities.—Zd85 and Zd88, Songsinni, SW of Sadong, P'yöngan-namdo.

Superfamilia Siphonotretaceae

Familia Obolellidae

Genus *Obolella* Billings

Obolella lunaris SAITO, sp. nov.

(Pl. II, figs. 1—5)

Obolella sp. β SAITO, 1933, Jour. Geol. Soc. Tokyo, vol. 40. p. 247. (Gives stratigraphic occurrences.)

Obolella sp. ind. SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 213. (Do.)

Material.—A number of casts of valves in argillaceous shale.

Description.—Externally, ventral and dorsal valves almost the same. Both valves subcircular or somewhat transversely oval in outline, moderately convex. Surface marked by concentric lines of growth. Although palintropes are not well shown in both valves, they seem extremely narrow; that of ventral valve seeming scarcely to rise above plane of margin of valve. Minute pedicle tube sometimes visible (Pl. II, fig. 4).

Interior of ventral valve has its greatest depth near centre. It shows a pair of elongate impressions near apex (to which probably the transmedian and anterior lateral muscles were attached), the visceral cavity (with heart-shaped cavity at its centre), and the main vascular sinuses which reach middle of valve.

Interior of dorsal valve has its greatest depth near posterior margin. From this point a rather obscurely raised part, V-shaped in outline, extends forward, but scarcely reaches middle of valve. On

each branch of this raised part is a central muscle scar. Close to posterior margin of valve is sometimes seen a pair of impressions, to which probably the transmedian and outside lateral muscles were attached. No vascular sinuses visible.

Remarks.—This species can easily be distinguished from other species hitherto known, except *O. asiatica* WALCOTT [1912, pl. 55; 1913, pl. 3] from Shantung. Nothing is known of the internal features of the latter; otherwise the two species are much alike, although the surface markings seem more pronounced in the Shantung form. It is possible that the present form may ultimately be referred to a subspecies of the WALCOTT's species.

Horizon.—Late Lower Cambrian, Lower *Redlichia* shales.

Localities.—D10, north of Chung-hwa; P10, near Söam; W21, near Ch'utangni; Chung-hwa-kun, P'yöngan-namdo. K60, north of Heuk-kyo; X14, north of Masanni; Hwangju-kun, Hwanghai-do. Many other localities in the Chung-hwa district.

Genus *Botsfordia* MATTHEW

Botsfordia granulata (REDLICH)

(Pl. II, figs. 6—11)

Mobergia granulata REDLICH, 1901, Mem. Geol. Surv. India, Pal. Indica, new ser., vol. 1, no. 1, p. 5, pl. 1, figs. 11—18.

Botsfordia granulata, WALCOTT, 1912, Monogr. U. S. Geol. Surv., vol. 51, p. 605, pl. 57, figs. 4, 4a-r.

Botsfordia sp. SAITO, 1933, Jour. Geol. Soc. Tokyo, vol. 40, pp. 249, 251. (Gives stratigraphic occurrences.)

Botsfordia cf. *granulata*, SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, pp. 213—215. (Do.)

Botsfordia cf. *granulata*, SAKAKURA, 1936, Jour. Geol. Soc. Japan, vol. 43, pp. 107, 108. (Do.)

Material.—A number of external and internal casts of valves more or less flattened in argillaceous shale.

Remarks.—Our specimens differ from the descriptions and figures by REDLICH and WALCOTT of *B. granulata* from India in the following points:

- 1) In the Korean specimens the apex of the ventral valve is situated a little in front of the posterior margin; while in the Indian specimens, it is situated a little behind the posterior margin [WALCOTT, 1912, p. 606].

- 2) In the Korean specimens, the longitudinal line through the apex of the ventral valve is not concave from the apex to the front margin as in the Indian specimens [WALCOTT, 1912, pl. 57, fig. 4f']. The dorsal valve is very gently convex.
- 3) The interiors of both valves of our specimens are essentially the same as those of the Indian specimens; but in ours no muscle scars are shown except a pair of large scars in the ventral valve which lies close to the main vascular sinuses and to each side of the pedicle opening. The visceral cavity of the ventral has no median groove as in the Indian specimens.

None of these differences are of any importance; many of them may be due merely to differences in the state of preservation, for which reason I think it best to refer our specimens to the REDLICH'S species.

Horizon.—This species has a long vertical range, as follows:

		Loc.	
Early Middle Cambrian	} <i>Ptychoparia</i> beds	common ...	{ B4, e11, T43, Zd87, etc.
Late Lower Cambrian	{ Upp. <i>Redlichia</i> shales	<i>Bonnia</i> zone	common ... e7.
		<i>Redlichia</i> cf. <i>walcotti</i> zone..	abundant... { J11, T6, X11, etc.
		<i>Neoredlichia nakamurai</i> zone...	rare..... 130.
		<i>Redlichia coreanica</i> zone...	absent
	Low <i>Redlichia</i> shales.....	rare	X14.

Localities.—B4 and 130, near Chunghwa, P'yöngan-namdo: J11, near Antakkol, Heukkyo-myön; T6, near Namtyöndong, Ch'öngsu-myön; T43, near Sindong, Ch'öngsu-myön; X11 and X14, north of Masanni, Songnim-myön; e7 and e11, near Hwangju Station; Hwangju-kun, Hwanghai-do: Zd87, Songsinni, SW of Sadong; Zd150 (*Redlichia* shales), Namjöngni, Taidonggang-myön; Taidong-kun, P'yöngan-namdo.

Ordo Neotremata

Superfamilia Paterinacea

Familia Paterinidae

Genus *Micromitra* MEEK

Subgenus *Iphidella* WALCOTT

Micromitra (*Iphidella*) sp. indef.

(Pl. I, figs. 18—21)

This is represented by several imperfect shells in limestone, all of which scarcely show any signs of the palintrope. They greatly resemble *M. (I.) pannula* (WHITE) [WALCOTT, 1912, pl. 4], a widely

distributed species in the Middle and Lower Cambrian, but are so poorly preserved that to identify them specifically is hazardous. The surfaces of the shells have the peculiar ornamentation characteristic of the *Iphidella* type; and are occasionally marked by fine obscure rugosities.

Horizon.—Early Middle Cambrian, limestone near base of *Ptychoparia* beds.

Locality.—F17, near Chunghwa, P'yöngan-namdo.

Superfamilia Acrotretacea

Familia Acrotretidae

Genus *Acrotreta* KUTORGA

Acrotreta coreanica SAITO, sp. nov.

(Pl. II, figs. 12—19)

Acrotreta sp. α SAITO, 1933, Jour. Geol. Soc. Tokyo, vol. 40, p. 247. (Gives stratigraphical occurrences.)

Acrotreta coreanica SAITO, MS., SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 213. (Do.)

Acrotreta coreanica SAITO, MS., SAKAKURA, 1936, Jour. Geol. Soc. Japan, vol. 43, p. 107 (Do.)

Material.—A number of specimens more or less compressed in argillaceous shale.

Description.—Shell rather large for the genus, the average diameter being about 3.0 mm. Surface marked by growth-lines and very fine concentric striae.

Ventral valve subcircular or somewhat transversely oval in outline. In the condition at present, it is lowly conical; although even in its original state it was probably not very high. Apex situated a little in front of the posterior margin. Palintrope usually not well-defined, narrow, somewhat incurved, and on a few specimens, marked by a faint median groove (Pl. II, fig. 14).

Dorsal valve subcircular in outline, slightly convex to nearly flat in present condition, with minute beak situated quite close to posterior margin of valve.

Interior of ventral valve shows medium-sized apical callosity, penetrated by foraminal tube, and a pair of short main vascular sinuses; a few valves show a pair of small cardinal scars.

In the interior of dorsal valve a narrow median septum extending slightly beyond middle of valve. A medium-sized cardinal scar

situated on each side of median septum and close to posterior margin of valve; central muscle scars slightly smaller than former, oval, and situated on sides of median septum, slightly behind traverse axis of valve. On some valves a pair of rounded grooves occur on the sides of median septum and posterior to central scars.

Remarks.—This species seems closely allied to *Acrotreta sagittalis* (SALTER) and its subspecies in Europe and North America, especially to *A. sagittalis taconica* WALCOTT [1912, pl. 71] of the American Lower Cambrian, which is characterized by the short median septum of the dorsal valve. In our species, however, the two valves are not quite the same in convexity as in the forms just mentioned, the ventral valve being more elevated than the dorsal.

Horizon.—Late Lower Cambrian, Lower *Redlichia* shales.

Localities.—L15 & U23, near Heukkyo; T30, near Taktong, Ch'öngsu-myön; X14, near Masanni, Songnim-myön; Hwanghai-do: and many other localities in the Chunghwa district. Zd20, near Pultangni, SE of P'yöngyang.

Acrotreta sp. indef.

Acrotreta sp. ind. SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 215. (Gives stratigraphic occurrences.)

Several specimens of an *Acrotreta*, resembling the preceding species, but very poorly preserved.

Horizon.—Early Middle Cambrian, *Ptychoparia* beds.

Locality.—e10, near Hwangju Station, Hwanghai-do.

Ordo Protremata

Superfamilia Orthacea

Familia Billingsellidae

Gen. et sp. indef.

(Pl. I, fig. 22)

Gen. et sp. ind. cf. *Billingsella*, SAKAKURA, 1936, Jour. Geol. Soc. Japan, vol. 43, p. 107. (Gives stratigraphic occurrences.)

Represented by a few internal casts, poorly preserved. The shape of the ventral valve resembles that of *Billingsella richthofeni* WALCOTT [1912, pl. 89], the only articulate brachiopod known from the *Redlichia* zone of eastern Asia.

Horizon.—Late Lower Cambrian, *Redlichia* shales (uppermost part).

Locality.—Zd50, Chungdong, SW of Sadong, P'yöngan-namdo.

Genus *Eoorthis* Walcott

Eoorthis? sp. indef.

(Pl. I, figs. 23, 24)

There are two specimens, a dorsal and a ventral valve. As however they do not show the palintrope and as the interior is invisible, it is with some diffidence that I assign this species to the genus *Eoorthis*. It differs from all the Asiatic species hitherto known by its relatively longer hinge-line. The ribs on the surface, which increase by interpolation, are crossed by concentric striae of growth.

Horizon.—Early Middle Cambrian, limestone near the base of the *Ptychoparia* beds.

Locality.—F17, near Chunghwa, P'yöngan-namdo.

PHYLUM MOLLUSCA

Classis Gastropoda

Ordo Aspidobranchia

Subordo Docoglossa

Familia Palaeacmaeidae

Genus *Helcionella* GRABAU et SHIMER

Helcionella acuticosta pacifica SAITO, subsp. nov.

(Pl. III, figs. 1—5)

Cf. *Stenotheca rugosa acuta-costa* WALCOTT, 1891, Tenth Ann. Rep. U. S. Geol. Surv. (1890), pt. 1, p. 617, pl. 74, figs. 2, 2a-b.

Cf. *Stenotheca rugosa orientalis* WALCOTT, 1905, Proc. U. S. Nat. Mus., vol. 29, p. 16.

Cf. *Helcionella rugosa orientalis* (WALCOTT), 1913, Research in China, vol. 3, p. 91, pl. 5, figs. 15, 15a.

Cf. *Helcionella rugosa acuticosta*, KIAER, 1916, Low. Cambr. Holmia Fauna at Tömten in Norway, p. 20, pl. 2, figs. 4, 4a.

Helcionella rugosa orientalis, SAITO, 1933, Jour. Geol. Soc. Tokyo, vol. 40, p. 252. (Gives stratigraphic occurrences.)

Helcionella rugosa orientalis, SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 214. (Do.)

Material.—Three specimens in limestone, and an external cast in shale.

Description.—The specimens quite agree with WALCOTT's figures of '*Stenotheca rugosa* HALL var. *acuta-costa* WALCOTT, except that the apex is somewhat more strongly bowed. Besides the concentric, strong, angular costae, the surface is marked by very fine, radiating striae (well shown in Pl. III, fig. 5), and very fine concentric striae.

Remarks.—Seeing that the 'varieties' of *Helcionella rugosa* (HALL) illustrated by WALCOTT [1891, pl. 74] are so different from each other, I cannot but regard most of them (including var. *acuta-costa*) as distinct species, well characterized by their surface markings. I further believe that the Korean shells represent a subspecies of the species *acuta-costa*. *Helcionella rugosa orientalis* WALCOTT of the Middle Cambrian of Shantung may be another subspecies of this species. The Tömten specimens shown by KIAER seem to differ from the Korean in that the concentric costae of the former are very closely arranged near the apertural margin.

Horizon.—Early Middle Cambrian, limestone near base of the *Ptychoparia* beds (F17). Late Lower Cambrian, top of the Upper *Redlichia* shales or the *Bonnia* zone (T33).

Localities.—F17, near Chunghwa, P'yöngan-namdo; T33, near Taktong, Ch'öngsu-myön, Hwangju-kun, Hwanghai-do.

Genus *Scenella* BILLINGS

Scenella clotho WALCOTT

(Pl. III, figs. 18, 19)

Scenella clotho WALCOTT, 1905, Proc. U. S. Nat. Mus., vol. 29, p. 12.

Scenella clotho WALCOTT, 1913, Research in China, vol. 3, p. 86, pl. 5, figs. 3, 3a.

Material.—Four specimens in limestone, apex wanting in all.

Description.—Our specimens agree with WALCOTT's original description and figures, except that in some of the former the apertural margin turns upward and that the apex seems somewhat less elevated than in the Shantung specimens.

Horizon.—Late Lower Cambrian, Upper *Redlichia* shales (probably *Bonnia* zone). In Shantung this species occurs in the Middle Cambrian.

Locality.—A10, near Chunghwa, P'yöngan-namdo.

Subordo Rhipidoglossa

Familia nova ?

Genus *Coreospira* SAITO, nov.

Nearly symmetrical, involute shells with a few volutions ; whorls rapidly enlarging, slightly carinate above and below, with vertical outer side ; aperture expanded.

Genotype.—*Coreospira rugosa* SAITO, gen. et. sp. nov.

Coreospira rugosa SAITO, gen. et. sp. nov.

(Pl. III, figs. 6—12)

Pelagiella? sp. SAITO, 1933, Jour. Geol. Soc. Tokyo, vol. 40, p. 249. (Gives stratigraphic occurrences.)

Pelagiella? sp. SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 213. (Do.)

Material.—Holotype in limestone ; three paratypes, which are external casts, scarcely flattened in shale. As we have no perfect specimen that shows both the upper and the lower surfaces of the shell at the same time, there is some doubt as to whether the shell of this species coils sinistrally or not.

Description.—Shell minute, consisting of about two whorls ; whorls rapidly enlarging, coiled nearly in the same plane, but slightly sinistrally(?). Upper side of shell broadly concave, rising outward to the low collar ; inner whorl somewhat depressed below the general surface of the outer whorl ; suture rather shallow. Inner whorl finely striated obliquely transversely ; outer whorl marked by strong, obliquely transverse rugosities ; both types of sculpture being seen in the beginning of the outer whorl. Collar low, obtusely carinate, very obscurely striated longitudinally, inconspicuous where the outer whorl begins. Under side of shell nearly the same as its upper side, except that the former is slightly more concave and the inner whorl more deeply depressed. Outer side of shell very slightly convex, finely striated transversely. Aperture slightly oblique, subtriangular in outline, expanded dorsally and laterally, and probably ventrally also.

Remarks.—So far as is known to me, this species is not allied to any form hitherto described. Its angular whorls somewhat resemble those of the Euomphalidae, but it differs from the latter in its rapidly enlarging whorls, in its expanded aperture, etc. These two characters just mentioned recall the Bellerophonitidae, from which,

however, our species is distinguished by its lack of the slit band, and by the angular whorls.

As this shell somewhat resembles certain Recent Heteropods and limacinid Pteropods, it is possible that this species was pelagic.

Ordo Opisthobranchia

Subordo Pteropoda

Familia Hyolithidae

Genus *Hyolithus* EICHWALD

Hyolithus kotô SAITO, sp. nov.

(Pl. III, figs. 20—23)

Material.—Several specimens in limestone, apex lacking in all.

Description.—Shell rather small, tapering at rate of about 4 mm. in 10 mm. Section of shell nearly a right-angled equilateral triangle, with its angles rounded and its edges slightly concave outward. Apex unknown. Aperture oblique, but without special extension of the dorsal surface. Surface of shell smooth, except in one specimen [pl. III, fig. 23] in which very obscure striae are visible both longitudinally and transversely.

Remarks.—This is a representative of the American *H. billingsi* WALCOTT [1886, pl. 13; 1891, pl. 75].

The specific name is given in honour of the late Dr. Bundjirô Kotô, a pioneer in Korean Geology.

Horizon.—Early Middle Cambrian, limestone near the base of the *Ptychoparia* beds.

Locality.—F17, near Chunghwa, P'yöngan-namdo.

Hyolithus globiger SAITO, sp. nov.

(Pl. III, figs. 13—17)

Orthotheca spp. SAITO (pars), 1933, Jour. Geol. Soc. Tokyo, vol. 40, p. 252.
(Gives stratigraphical occurrences.)

Orthotheca sp. SAITO (pars), 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 214. (Do.)

Material.—A number of specimens in limestone.

Description.—Shell rather small, slightly curved ventrally near the apex, tapering at rate of about 1.5 mm. in 10 mm. Section of shell subcircular, somewhat flattened dorsally. Apex rounded. Apertural part not perfectly preserved in our specimens, but there is no

doubt that it was oblique, although without any special extension of the dorsal surface. Surface of shell smooth.

Operculum, of which there is only a single specimen, is subcircular in outline, its surface marked by obscure concentric striae.

Apex preserved only in the holotype, which former seems somewhat inflated as shown in Pl. III, fig. 17. It may be the protoconch, seeing that it resembles the bulbous protoconchs that are preserved as apices of some later pteropod shells of the family Cavolinidae [COLLINS, 1934, pl. 13] and of some *Tentaculites* [NOVÁK, 1882, pl. 12; ZITTEL, 1927, fig. 1073 C].

Remarks.—Several species are known, resembling more or less the present species, e. g., *H. communis* BILLINGS [WALCOTT, 1886, pl. 14; 1891, pl. 77]. Of the Asiatic species, *Orthotheca daulis* WALCOTT and *O. glabra* WALCOTT [1913, pl. 5] are much like ours, but they are believed to have a transverse aperture.

Horizon.—Early Middle Cambrian, limestone near the base of the *Ptychoparia* beds.

Locality.—F17, near Chunghwa, P'yöngan-namdo.

Hyolithus teretapex SAITO, sp. nov.

(Pl. III, figs. 24—31)

Hyolithes sp. SAITO, 1934, Jap. Jour. Geol. Geogr., vol. 11, p. 212. (Gives stratigraphic occurrences.)

Material.—A number of specimens (mostly casts) somewhat flattened (?) in arenaceous shale.

Description.—Shell medium size with elliptical section, tapering moderately. Apex rounded. Aperture oblique, as indicated by shape of operculum and the oblique growth lines.

Operculum may be regarded as consisting of two circular plates, the outer and the inner, placed at an angle and connected to each other by means of paired plates. We have consequently four kinds of operculum casts;

- 1) Cast of exterior surface of outer plate, consisting of a plane ventral area and a convex dorsal area, both concentrically striated. (Pl. III, fig. 28.)
- 2) Cast of interior surface of outer plate, with casts of connecting plates as deep grooves. (Pl. III, fig. 29.)
- 3) Cast of interior surface of inner plate, with casts of connecting plates as deep grooves. (Pl. III, fig. 30.)

- 4) Cast of the plane exterior surface (facing the animal body) of inner plate. (Pl. III, fig. 31.)

Remarks.—This represents in form the American *Hyalolithus impar* FORD [WALCOTT, 1886, Pl. 14; 1891, Pl. 77] and the European *H. fortis* BARRANDE [1867, p. 82, Pl. 15; ZÁZVORKA, 1930, Pl. 1].

It is interesting that in this species also the apex is not pointed, but rounded as in the preceding species, suggesting the subspheric protoconch.

Horizon.—Lower Cambrian, *Protolenus* shale.

Locality.—K15, Kuhyöneh'i Pass, north of Heukkyo, Hwanghai-do.

Appendix :—Changes in Systematic Reference of Some Trilobites Previously Described by the Writer.

Agnostus chinensis DAMES, SAITO [1934, p. 217]

= *Agnostus rakuroensis* KOBAYASHI [1935, p. 103]

= *Diplorrhina rakuroensis* (KOB.), WHITEHOUSE [1936, p. 90]

= *Peronopsis rakuroensis* (KOB.)

Arthricocephalus? primigenius SAITO [1934, p. 232]

= *Cheiruroides* KOBAYASHI [1935, p. 163]

Redlichia nakamurai SAITO [1934, p. 224]

= *Neoredlichia* n. g.

Genus *Neoredlichia* SAITO, nov.: Founded on *Redlichia nakamurai* SAITO. Distinguished from *Redlichia* COSSMANN by the more forward direction of the preocular facial sutures and by the shorter palpebral lobes.

List of Localities.

- A10.—Lower Cambrian, limestone near top of Upper *Redlichia* shales (probably *Bonnia* zone): hill west of Chunghwa; 1.5 km. NW of Chunghwa, P'yöngan-namdo.
- B4.—Middle Cambrian, lower part of *Ptychoparia* beds: south slope of hill west of Chunghwa; 0.8 km. NW of Chunghwa, P'yöngan-namdo.
- D3.—Lower Cambrian, Upper *Redlichia* shales (*Bonnia* zone): grey limestone lens, south slope of Oknobong hill; 0.8 km. NE of Chunghwa, P'yöngan-namdo.
- D10.—Lower Cambrian, pisolitic limestone at base of Lower *Redlichia* shales: north slope of hill north of Chunghwa; 1.7 km. north of Chunghwa, P'yöngan-namdo.
- e7.—Lower Cambrian, Upper *Redlichia* shales (*Bonnia* zone): north foot of hill east of Hwangju Station, Hwanghai-do.
- e10.—Middle Cambrian, *Ptychoparia* beds (40 m. above e7, same section): north foot of hill east of Hwangju Station, Hwanghai-do.

- e 11.—Middle Cambrian, *Ptychoparia* beds (28 m. above e10, same section): north foot of hill east of Hwangju Station, Hwanghai-do.
- F17.—Middle Cambrian, grey limestone near base of *Ptychoparia* beds: south slope of Ch'öngnyongsan hill; 1.3 km. ENE of Chunghwa, P'yöngan-namdo.
- G9.—Lower Cambrian, Upper *Redlichia* shales (*Bonnia* zone): $\frac{1}{4}$ km. ESE of the 95 m. triangulation-point on Unbongsan hill; 2.0 km. west of Chunghwa, P'yöngan-namdo.
- I 30.—Lower Cambrian, Upper *Redlichia* shales (*Neoredlichia nakamurai* zone): valley between Oknobong and Ch'öngnyongsan hills; 1.2 km. NE of Chunghwa, P'yöngan-namdo.
- J 11.—Lower Cambrian, Upper *Redlichia* shales (*Redlichia* cf. *walcotti* zone): ridge immediately east of Antakkol, Heukkyo-myön, Hwangju-kun, Hwanghai-do.
- K15.—Lower Cambrian, *Protoleues* shale: railway-cutting immediately south of tunnel under Kuhyönch'i Pass, 2.0 km. north of Heukkyo, Hwanghai-do.
- L15.—Lower Cambrian, lower part of Lower *Redlichia* shales: 1.8 km. WNW of Heukkyo, Hwanghai-do.
- P10.—Lower Cambrian, Lower *Redlichia* shales: hill south of Söam, Sinheung-myön, Chunghwa-kun, P'yöngan-namdo.
- Q13.—Lower Cambrian, Upper *Redlichia* shales (*Bonnia* zone): 0.4 km. SW of Hanjöngdong, Ch'öngsu-myön, Hwangju-kun, Hwanghai-do.
- S4.—Middle Cambrian, *Ptychoparia* beds (Ssukkol shale): low bluff between Ssukkol and Chowanggol, Heukkyo-myön, Hwangju-kun, Hwanghai-do.
- S8.—Lower Cambrian, Upper *Redlichia* shales: hill 0.3 km. west of Ssukkol, Heukkyo-myön, Hwangju-kun, Hwanghai-do.
- S11.—Lower Cambrian, Lower *Redlichia* shales: 0.5 km. NNW of Ssukkol, Heukkyo-myön, Hwangju-kun, Hwanghai-do.
- T6.—Lower Cambrian, Upper *Redlichia* shales: 1 km. NNW of Namtyöngdong, Ch'öngsu-myön, Hwangju-kun, Hwanghai-do.
- T30.—Lower Cambrian, Lower *Redlichia* shales: 1.2 km. NE of Taktong, Ch'öngsu-myön, Hwangju-kun, Hwanghai-do.
- T33.—Lower Cambrian, Upper *Redlichia* shales (*Bonnia* zone): south slope of hill east of Taktong, Ch'öngsu-myön, Hwangju-kun, Hwanghai-do.
- T43.—Middle Cambrian, *Ptychoparia* beds: 1.2 km. NNW of Sindong, Ch'öngsu-myön, Hwangju-kun, Hwanghai-do.
- U23.—Lower Cambrian, Lower *Redlichia* shales: 1 km. NE of Angol, east of Heukkyo, Hwanghai-do.
- W21.—Lower Cambrian, Lower *Redlichia* shales: ridge west of Ch'utangani, Chunghwa-myön, Chunghwa-kun, P'yöngan-namdo.
- X11.—Lower Cambrian, Upper *Redlichia* shales: hill 1 km. north of Masanni, Songnim-myön, Hwangju-kun, Hwanghai-do.
- X14.—Lower Cambrian, Lower *Redlichia* shales: isolated hill 1.3 km. north of Masanni, Songnim-myön, Hwangju-kun, Hwanghai-do.
- Zd20.—Lower Cambrian, *Redlichia* shales (*Redlichia* zone): 0.4 km. NW of Pultangani, Yülmi-myön, Taidong-kun, P'yöngan-namdo.

- Zd50.—Lower Cambrian, *Redlichia* shales (*Redlichia* zone): Chungdong, Yülmi-myön, Taidong-kun, P'yöngan-namdo.
- Zd85.—Middle Cambrian, *Ptychoparia* beds (*Proliostracus? brevicaudatus* zone): Songsinni, SW of Sadong, Yülmi-myön, Taidong-kun, P'yöngan-namdo.
- Zd87.—Middle Cambrian, *Ptychoparia* beds (*Proliostracus? brevicaudatus* zone): 0.3 km. SSE of Songsinni, SW of Sadong, Yülmi-myön, Taidong-kun, P'yöngan-namdo.
- Zd88.—Middle Cambrian, *Ptychoparia* beds (*Proliostracus? brevicaudatus* zone): 0.3 km. SSE of Songsinni, SW of Sadong, Yülmi-myön, Taidong-kun, P'yöngan-namdo.
- Zd150.—Lower Cambrian, *Redlichia* shales: Namjöngni, Taidonggang-myön, Taidong-kun, P'yöngan-namdo.

List of Geographic Names.

Angol	內洞	Namjöngni	南井里
Antakkol	安宅洞	Namtyöngdong	楠亭洞
Ch'öngnyongsan	青龍山	Oknobong	玉露峯
Ch'öngsu-myön	清水面	Pultangni	佛堂里
Chowanggol	助王洞	P'yöngan-namdo	平安南道
Chungdong	中洞	P'yöngyang	平壤
Chunghwa	中和	Sadong	寺洞
Chunghwa-kun	中和郡	Sindong	新洞
Chunghwa-myön	中和面	Sinheung-myön	新興面
Ch'utangni	楸唐里	Söam	西岩
Hanjöngdong	寒井洞	Songnim-myön	松林面
Heizyô	平壤	Songsinni	松新里
Heukkyo	黑橋	Ssukkol	艾洞
Heukkyo-myön	黑橋面	Taidonggang-myön	大同江面
Hwanghai-do	黃海道	Taidong-kun	大同郡
Hwangju	黃州	Taktong	析洞
Hwangju-kun	黃州郡	Unbongsan	雲峯山
Kuhyönc'h'i	駒嶺峙	Yülmi-myön	栗里面
Masanni	馬山里	Zidô	寺洞

Literature cited.

- BARRANDE, J. 1867. *Système silurien du centre de la Bohême, 1^{ère} partie, vol. 3, Ptéropodes.*
- COLLINS, R. L. 1934. *A monograph of American Tertiary Pteropod Mollusks.* Johns Hopkins Univ., *Studies in Geology*, no. 11, Contributions to Palaeontology and Mineralogy, pp. 137-234, pls. 7-14.
- KIAER, Johan. 1916. *The Lower Cambrian Holmia Fauna at Tömten in Norway.* Videnskapsselskapets Skrifter, I. Mat.-Naturv. Klasse, 1916, no. 10.
- KOBAYASHI, T. 1935. *The Cambro-Ordovician Formations and Faunas of South*

- Chosen. Palaeontology. Pt. 3. Cambrian Faunas of South Chosen with a special study on the Cambrian Trilobite Genera and Families. Jour. Fac. Sci., Imp. Univ. Tokyo, sec. II, vol. 4, pt. 2, pp. 49-344, 24 pls.
- MANSUY, H. 1912. Etude géologique du Yunnan oriental, 2^e partie, Paléontologie. Mém. Serv. Géol. l'Indochine, vol. 1, fasc. 2, pp. 1-146, pls. 1-25.
- NOVÁK, O. 1882. Ueber böhmische, thüringische, griefensteiner und harzer Tentaculiten. Beitr. z. Geologie u. Paläontologie Österreich-Ungarns u. des Orients. vol. 2, pp. 47-70, pls. 12, 13.
- REDLICH, K. A. 1901. The Cambrian fauna of the eastern Salt-Range. Mem. Geol. Surv. India, Palaeontologia Indica, new ser., vol. 1, pp. 1-13, pl. 1.
- SAITO, K. 1933. The occurrence of Protolenus in the Cambrian rocks of North Korea. Jap. Jour. Geol. Geogr., vol. 10, pp. 145-151, 7 textfigs.
- 1933. Cambrian formations in the Chunghwa district, western North Korea. (In Jap.). Jour. Geol. Soc. Tokyo, vol. 40, pp. 242-260, 3 textfigs., pl. 10.
- 1934. Older Cambrian Trilobita and Conchostraca from North-western Korea. Jap. Jour. Geol. Geogr., vol. 11, pp. 211-237, 8 textfigs., pls. 25-27.
- SAITO, K. et K. SAKAKURA. 1936. Description des deux nouvelles espèces de Trilobite. Jour. Geol. Soc. Japan, vol. 43, pp. 112-117, pl. 8.
- SAKAKURA, K. 1936. The Cambrian formation, southeast of the Zidô thrust, Korea. (In Jap., with French Résumé). Jour. Geol. Soc. Japan, vol. 43, pp. 104-112, pls. 6, 7.
- THOMSON, J. A. 1927. Brachiopod Morphology and Genera (Recent and Tertiary). New Zealand Board of Science and Art, Manual no. 7, 338 pp., 2 pls., Wellington.
- WALCOTT, C. D. 1886. Second contribution to the studies of the Cambrian faunas of North America. Bull. U. S. Geol. Surv., no. 30, pp. 1-222, pls. 1-33.
- 1891. The Fauna of the Lower Cambrian or Olenellus Zone. Tenth Ann. Rep. U. S. Geol. Surv., 1890, pt. 1, pp. 509-774, pls. 43-98.
- 1905. Cambrian faunas of China. Proc. U. S. Nat. Mus., vol. 29, pp. 1-106.
- 1912. Cambrian Brachiopoda. Mon. U. S. Geol. Surv., vol. 51.
- 1913. The Cambrian faunas of China. 'Research in China,' vol. 3, pp. 1-228, pls. 1-24.
- 1917. Cambrian Geology and Paleontology, IV, no. 3.—Fauna of the Mount Whyte formation. Smiths. Misc. Coll., vol. 67, no. 3, pp. 61-114, pls. 1-13.
- 1920. Cambrian Geology and Paleontology, IV, no. 6.—Middle Cambrian Spongiae. Smiths. Misc. Coll., vol. 67, no. 6, pp. 261-364, pls. 60-90.
- WHITEHOUSE, F. W. 1936. The Cambrian faunas of north-eastern Australia, pts. 1 & 2. Mem. Queensland Mus., vol. 11, pt. 1.
- YABE, H. and K. OZAKI. 1930. Girvanella in the Lower Cambrian of South Manchuria. Sci. Rep. Tohoku Imp. Univ., Sendai, Japan, vol. 14, pp. 79-83, pl. 25, 1 textfig.
- ZÁZVORKA, V. 1930. Revision of the Hyolithi from dy. Palaeontographica

Older Cambrian Brachiopoda, etc. from North-western Korea.

367

Bohemiae, no. 13, 22pp., 3 pls.

ZITTEL, K. A. v. 1927. (Translated and edited by C. R. EASTMAN). Text-Book of Paleontology, vol. 1.

Geological Institute, Imperial University of Tokyo. April, 1936.

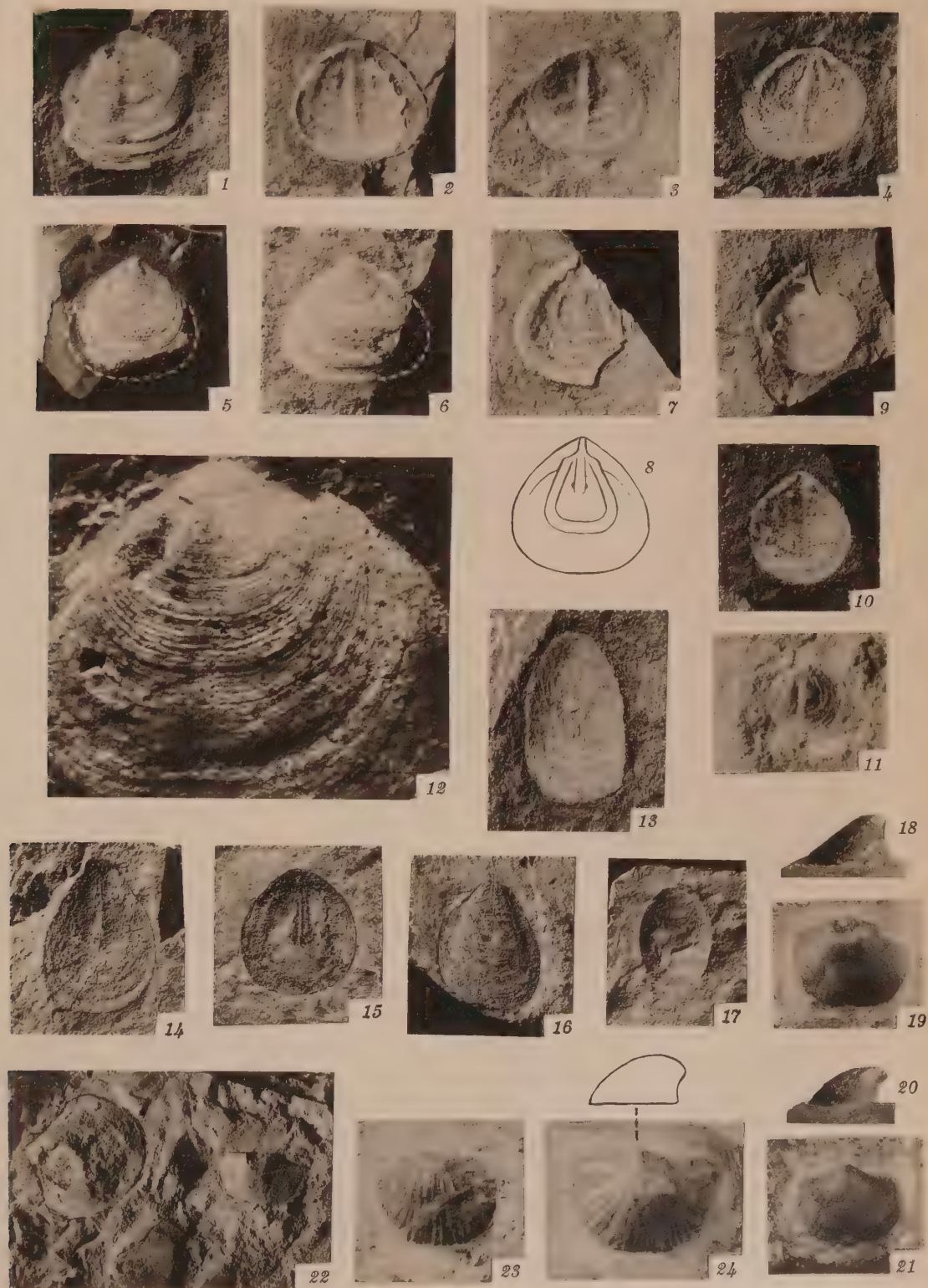
K. Saito: Older Cambrian Brachiopoda, Gastropoda, etc.

Plate I.

Cambrian Brachiopoda.

All the specimens are figured as illuminated from the upper left-hand side.—The numbers in square brackets are those under which the specimens are registered in the author's collection.—All the specimens are deposited in the Museum of the Geological Institute, Faculty of Science, Imperial University, Tokyo.

- Obolopsis margaritae* SAITO, gen. et sp. nov.p. 349
- Fig. 1. [1004] ×3. Holotype of dorsal valve, showing median sinus.
2. [1009] ×3. Interior of dorsal valve. Note narrow median septum on median ridge.
3. [1020] ×3. Interior of dorsal valve with strong median ridge.
4. [1026] ×3. Interior of dorsal valve, somewhat weathered.
5. [1013] ×3. Ventral valve with surface weathered. Note a pair of minute depressions near apex.
6. [1031] ×3. Ventral valve.
7. [1012] ×3. Interior of ventral valve; pedicle groove partially preserved. Holotype of ventral valve.
8. [1012] ×3. Diagrammatic sketch of same specimen to show visceral area and vascular markings.
9. [1033] ×3. Interior of ventral valve; pedicle groove partially preserved.
10. [1014] ×3. Interior of ventral valve, apparently somewhat weathered.
11. [1005] ×5. Cast of interior of small dorsal valve doubtfully referred to this species, showing two pairs of vascular sinuses.
12. [1004] ×15. Part of surface of holotype of dorsal valve.
- Lingulella* sp. indef.p. 353
- Fig. 13. [1568] ×3. Cast of interior of dorsal valve.
- Obolus* cf. *detritus* MANSUYp. 351
- Fig. 14. [1368] ×5. Cast of exterior of ventral valve. Loc. Zd20.
15. [1366] ×5. Interior of dorsal valve. Loc. Zd20.
- Obolus* sp. indef.p. 352
- Fig. 16. [1566] ×3. Exterior of ventral valve.
17. [1567] ×3. Cast of exterior of dorsal valve.
- Micromitra* (*Iphidella*) sp. indef.p. 355
- Figs. 18, 19. [1558] ×4. Side and apical views of ventral valve.
- 20, 21. [1563] ×4. Side and apical views of dorsal (?) valve.
- Gen. et sp. indef. (Billingsellidae)p. 357
- Fig. 22. [1214] ×2. Poorly preserved casts of ventral (left-hand) and dorsal (right-hand) valves.
- Eoorthis?* sp. indef.p. 358
- Fig. 23. [1561] ×3. Incomplete dorsal valve.
24. [1560] ×3. Top view and side outline of ventral valve.



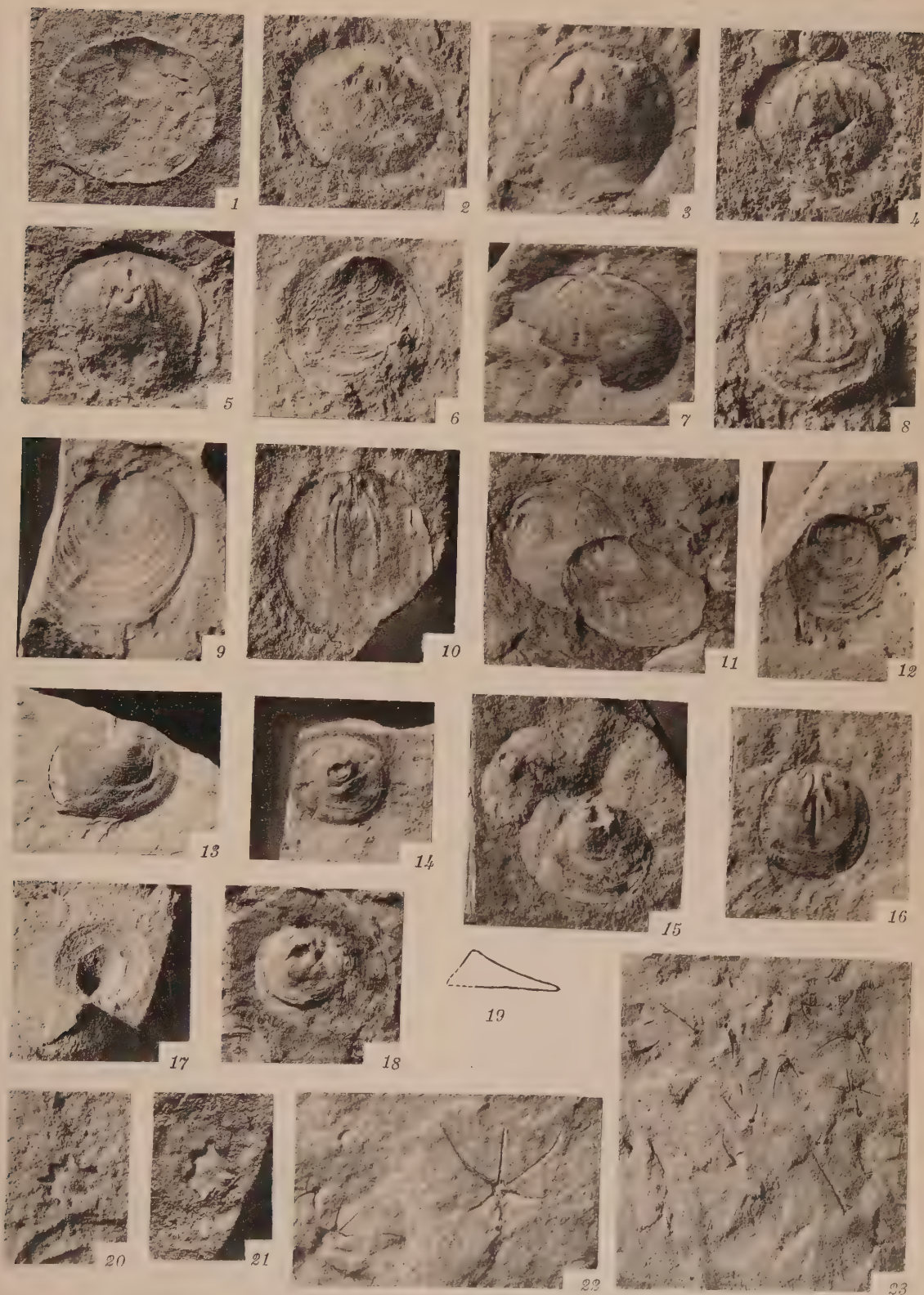
K. Saito: Older Cambrian Brachiopoda, Gastropoda, etc.

Plate II.

Cambrian Brachiopoda, etc.

All the specimens are figured as illuminated from the upper left-hand side.—The numbers in square brackets are those under which the specimens are registered in the author's collection.—All the specimens are deposited in the Museum of the Geological Institute, Faculty of Science, Imperial University, Tokyo.

- Obolella lunaris* SAITO, sp. nov.p. 353
- Fig. 1. [12151] $\times 2.5$. Cast of exterior of dorsal valve. Loc. X14.
2. [1215a] $\times 2.5$. Cast of interior of dorsal valve. Holotype of dorsal valve. Loc. X14.
3. [1103] $\times 3$. Cast of interior of dorsal valve. Loc. D10.
4. [1215g] $\times 2.5$. Cast of interior of ventral valve. Note cast of minute pedicle tube. Holotype of ventral valve. Loc. X14.
5. [1214a] $\times 3$. Cast of interior of ventral valve. Loc. X14.
- Botsfordia granulata* (REDLICH)p. 354
- Fig. 6. [1506] $\times 4$. Exterior of ventral (?) valve. Loc. B4.
7. [1321] $\times 3$. Cast of interior of dorsal valve. Loc. J11.
8. [1336] $\times 4$. Cast of interior of dorsal valve. Loc. T6.
9. [1315] $\times 3$. Cast of interior of ventral valve. Loc. J11.
10. [1313] $\times 3$. Cast of interior of ventral valve. Loc. J11.
11. [1317] $\times 3$. Casts of interior of a ventral (left-hand) and a dorsal (right-hand) valve. Loc. J11.
- Acrotreta coreanica* SAITO, sp. nov.p. 356
- Fig. 12. [1152] $\times 5$. Cast of exterior of dorsal valve. Loc. T30.
13. [1164] $\times 5$. Exterior of ventral valve to show surface features. Loc. U23.
14. [1120] $\times 5$. Exterior of ventral valve. Holotype of ventral valve. Loc. L15.
15. [1205] $\times 5$. Casts of interior of ventral valves. Loc. X14.
16. [1145] $\times 5$. Cast of interior of dorsal valve. Holotype of dorsal valve. Loc. T30.
17. [1142] $\times 5$. Cast of exterior of ventral valve. Loc. T30.
18. [1218] $\times 5$. Cast of interior of ventral valve. Loc. X14.
19. [1208] $\times 5$. Side outline of a cast of exterior of ventral valve, apparently somewhat compressed. Loc. X14.
- Gen. et sp. indef. (cf. *Gogia*)p. 349
- Fig. 20. [560] $\times 5$. Cast of isolated plate of calyx. Loc. S4.
21. [540] $\times 5$. Cast of isolated plate of calyx. Loc. S4.
- Chancelloria exilis* SAITO, sp. nov.p. 348
- Fig. 22. [1166] $\times 10$. Casts of six-rayed spicule (holotype) and some others. Loc. S11.
23. [1165] $\times 2$. Casts of isolated spicules. Loc. T30.



K. Saito: Older Cambrian Brachiopoda, Gastropoda, etc.

Plate III.

Cambrian Gastropoda.

All the specimens are figured as illuminated from the upper left-hand side.—The numbers in square brackets are those under which the specimens are registered in the author's collection.—All the specimens are deposited in the Museum of the Geological Institute, Faculty of Science, Imperial University, Tokyo.

- Helcionella acuticosta pacifica* SAITO, subsp. nov.p. 358
 Figs. 1, 2. [1553] $\times 12$. Side views of holotype (in limestone), lacking apex and apertural margin. Loc. F17.
 3. [1553] $\times 12$. Cross-section (restored) of same specimen through the last costa.
 4. [1555] $\times 12$. Side view of a complete specimen (in limestone). Loc. F17.
 5. [1564] $\times 8$. Cast of exterior of a large shell (in shale) showing fine longitudinal striae. Loc. T33.
- Coreospira rugosa* SAITO, gen. et sp. nov.p. 360
 Fig. 6. [1363] $\times 10$. Lower view of holotype (in limestone). Loc. D3.
 7. [1363] $\times 10$. Holotype, viewed perpendicular to plane of apertural margin.
 8. [376] $\times 5$. Cast of lower side of shell (in shale). Note fine striae on inner whorl.* Loc. Q13.
 9, 10. [1362] $\times 5$. Cast of upper side of shell (in shale) and its plaste-line cast. Loc. Q13.
 11, 12. [1361] $\times 5$. Cast of upper side of shell (in shale) and its plasteline cast. Loc. Q13.
- Hyolithus globiger* SAITO, sp. nov.p. 361
 Fig. 13. [1539] $\times 3$. Dorsal view of a paratype, with entire apertural margin.
 14. [1540] $\times 3$. Dorsal view and cross-section of another paratype, both ends of shell lacking.
 15. [1536] $\times 3$. Operculum.
 16. [1532] $\times 3$. Lateral view of holotype.
 17. [1532] $\times 9$. Apical part of same specimen to show inflated protoconch(?).
- Seenella clotho* WALCOTTp. 359
 Fig. 18. [1301] $\times 5$. Apical view of shell; apex lacking.
 19. [1300] $\times 5$. Counterpart of same specimen.
- Hyolithus kotôji* SAITO, sp. nov.p. 361
 Figs. 20-22. [1562] $\times 3$. Three views and cross-section of holotype, with almost entire apertural margin, but without apex.
 23. [1542] $\times 3$. Ventral view of a paratype with entire apertural margin, but without apex.
- Hyolithus teretapex* SAITO, sp. nov.p. 362
 Fig. 24. [1039] $\times 3$. Cast of exterior of shell with fragmental internal cast.
 25. [1055] $\times 3$. Cast of exterior of dorsal side of shell showing growth-lines.
 26. [1041] $\times 3$. Cast of exterior of shell showing rounded apex. Holotype.
 27. [1040] $\times 3$. Cross-section of shell.
 28. [1050] $\times 3$. Cast of exterior surface of outer plate of operculum.
 29. [1051] $\times 3$. Counterpart of same specimen; cast of interior surface of outer plate of operculum.
 30. [1044] $\times 4$. Cast of interior surface of inner plate of operculum.
 31. [1045] $\times 4$. Counterpart of same specimen; cast of exterior surface (facing animal) of inner plate of operculum.



JOURNAL OF THE FACULTY OF SCIENCE IMPERIAL UNIVERSITY OF TOKYO

SECTION I. MATHEMATICS, ASTRONOMY, PHYSICS, CHEMISTRY

Vol. I, II. Completed.

Vol. III, Part 1. H. Nakano, Zur Theorie der gewöhnlichen Differentialgleichungen.

Price ¥ 1.20

Vol. III, Part 2. S. Fujiwara, K. Nakata, H. Sibahasi, M. Uda, S. Oka, A. Harasima, and N. Watanabe:—On Vorticity in the Atmosphere as a Weather Factor.

R. Uyeda, Y. Oka and M. Terashima:—Notes on Correlations between the Upper Wind and the Meteorological Elements.

Price ¥ 2.00

Vol. III, Part 3. T. Soda, Ueber Glucosulfatase, ein neues Enzym, welches Zuckerschweifelsäure spaltet.

Price ¥ 1.40

SECTION II. GEOLOGY, MINERALOGY, GEOGRAPHY, SEISMOLOGY

Vol. I, II, III. Completed.

Vol. IV, Part I. K. Sakakura, Pliocene and Pleistocene Bryozoa from the Bôso Peninsula, (I).

Price ¥ 1.20

" Part 2. T. Kobayashi, The Cambro-Ordovician Formations and Faunas of South Chosen. Palaeontology, Part III. Cambrian Faunas of South Chosen with a Special Study on the Cambrian Trilobite Genera and Families. Price ¥ 5.00

" Part 3. K. Saito, Older Cambrian Brachiopoda, Gastropoda, etc. from North-western Korea.

Price ¥ 0.70

SECTION III. BOTANY

Vol. I, II, III. Completed.

Vol. IV, Part 1. K. Ohki, On the Systematic Importance of Spodograms in the Leaves of the Japanese Bambusaceae.

Price ¥ 1.70

" Part 2. Y. Satake, Systematic and Anatomical Studies on Some Japanese Plants, II. (JUNCACEAE).

Price ¥ 1.80

" Part 3. S. Watari, Anatomical Studies on Some Leguminous Leaves, with Special Reference to the Vascular System in Petioles and Rachises.

Price ¥ 2.90

" Part 4. T. Miduno, Zytologische Untersuchungen der Bryophyten, I. Die Morphologie der Spermatozoiden einiger Hepaticen. A. Yuasa, Studies in the Cytology of Pteridophyta. V.

Price ¥ 0.90

SECTION IV. ZOOLOGY

Vol. I, II. Completed.

Vol. III, Part 1

Price ¥ 1.60

" Part 2

Price ¥ 3.00

SECTION V. ANTHROPOLOGY

Vol. I, Part 1. A. Matsumura, On the Cephalic Index and Stature of the Japanese and their Local Differences. A Contribution to the Physical Anthropology of Japan. Plates I—X.

Price ¥ 11.00

CONTENTS

K. SAITO:—Older Cambrian Brachiopoda, Gastropoda, etc. from North-western Korea.	345
---------------------------------------------------------------------------------------------	-----

This JOURNAL is on sale at

MARUZEN Co., LTD.

6, Nihonbashi Tori-Nichome, Tokyo

R. FRIEDLÄNDER & SOHN

Karlstr. 11, Berlin, N.W. 6

Price in Tokyo: Yen 0.70 for this Part

昭和十一年七月二十五日印刷
昭和十一年七月三十日發行

編纂兼發行者

東京帝國大學

印刷者 東京市深川區白河町四丁目一番地一
星野 錫

印刷所 東京市深川區白河町四丁目一番地一
東京印刷株式會社

賣捌所 東京市日本橋區通二丁目六番地
丸善株式會社